UNIVERSITY OF NATAL

PIETERMARITZBURG

SOUTH AFRICA

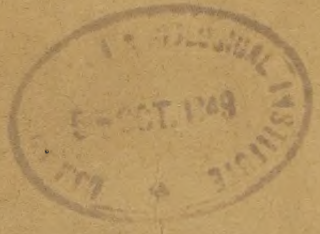
WATTLE RESEARCH INSTITUTE

South African Wattle Growers' Union – University Of Natal –

Union Department Of Forestry

REPORT FOR 1948

(FIRST YEAR)



APRIL, 1949

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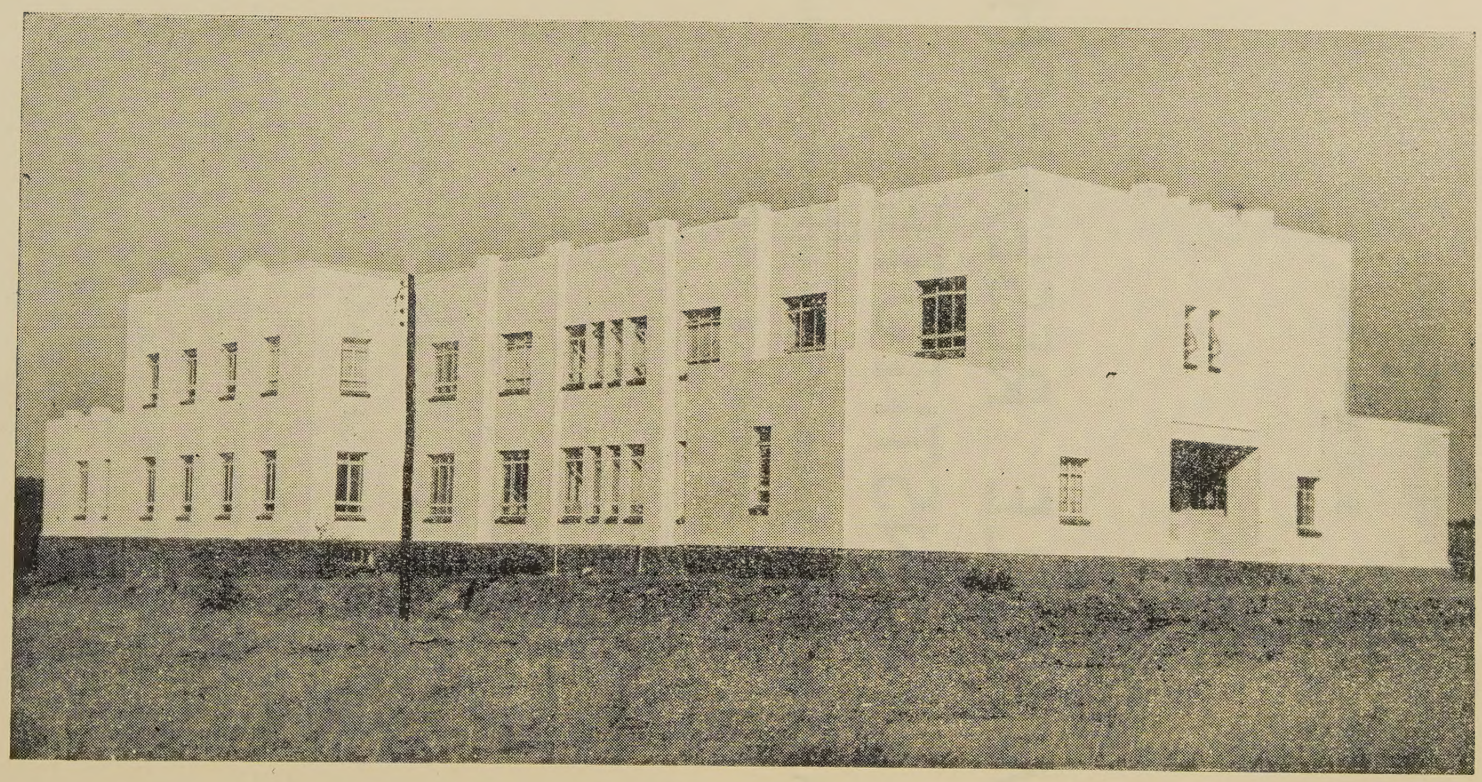

WATTLE RESEARCH INSTITUTE, PIETERMARITZBURG

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COMMITTEE OF CONTROL OF THE INSTITUTE

Appointed by the South African Wattle Growers' Union (3) :

S. Clegg, Esq.

R. B. Fyfe, Esq. (Appointed August, 1948.)

J. A. Lidgett, Esq., M.P.C. (Deceased May, 1948.)

D. R. Scott, Esq.

Appointed by Natal University College (2) :

Professor S. F. Bush, M.Sc., D.Phil.

Principal E. G. Malherbe, M.A., Ph.D., LL.D. (Chairman.)

Appointed by the Union Government Department of Forestry (1) :

H. B. Stephens, Esq., B.Sc., Dip. For.

The Director :

Professor H. Shaw, M.Sc., Ph.D., F.R.I.C.

Honorary Secretary :

P. G. Leeb-du Toit, Esq., B.Com. (Registrar, Natal University College.)

STAFF

DIRECTOR :

H. Shaw, M.Sc.Tech., Ph.D. (Manc.), F.R.I.C. (Appointed May, 1947.)

Silviculture :

S. P. Sherry, M.A. (Oxon.), B.Sc. (South Africa). (Appointed February, 1948.)

Technical Assistants :

N. J. Cunningham. (Appointed February, 1948.)

M. J. Lourens. (Appointed August, 1948.)

Genetics and Plant Breeding :

A. A. Moffett, B.Sc. (Birm.), Ph.D. (Lond.). (Appointed April, 1948.)

Technical Assistant :

A. M. Gale. (Appointed March, 1948, resigned May, 1948.)

Chemistry :

W. S. Martin, Ph.D., D.Sc. (Lond.), A.R.C.S., D.I.C., A.R.I.C. (Appointed March, 1948.)

Technical Assistant :

E. Hickman. (Appointed March, 1948, resigned August, 1948.)

Administration :

Miss A. P. J. Moberly. (Appointed May, 1948.)

Non-European :

Two.

FOREWORD

The presentation of a Report on the Wattle Research Institute when its work is scarcely begun may appear to be somewhat premature. The time is opportune, however, to place on record a brief account of the conception and development of the idea of a Research Institute and the way in which that idea is being worked out and brought to fulfilment. The constitutional relation of the Institute to the wattle industry, the University, and the Government is itself an experiment and may be of interest to other research organizations.

The research programme presented is of a tentative and very fluid nature designed only to crystallize early ideas. It will be modified and extended as necessary when the various lines of work open out and take shape and as new problems become apparent.

The publication of this Report cannot pass without mention being made of the death of Mr. J. A. Lidgett, M.P.C., on the 29th May, 1948. As President of the South African Wattle Growers' Union, Mr. Lidgett had been intimately associated from their inception with the negotiations leading to the establishment of the Institute. He served on the Union's Research Board and subsequently was one of the Union's first nominees on the Committee of Control. His intense interest in the project was beyond question and it would have been no more than fitting if his enthusiasm had been rewarded by the sight of the Institute in full operation. Although this was denied him, his name stands permanently enshrined in the Institute on the foundation stone that he laid on the 2nd November, 1946.

H.S.

April, 1949.

HISTORICAL

Somewhere about 1937 a number of growers, under the stimulus of discussions with the Research Officers of the Department of Forestry, began to take an interest in the idea of a Wattle Research Institute. It was felt that the importance of the industry merited the establishment of a research organization devoted exclusively to the improvement of wattle cultivation and tannin production and into which all the various lines of research on wattle could be gathered as a co-ordinated whole.

In November, 1938, a Special Congress of the newly formed South African Wattle Growers' Union established a Pest Eradication Fund financed by a contribution from all exports of wattle bark and extract, and shortly afterwards the Union accepted responsibility for part of the salary of a wattle pathologist working in the Division of Botany and Plant Pathology in the Department of Agriculture. In this way the general body of growers was made aware of the need for and value of research in the industry and when, at the 1940 Congress, a resolution was moved urging the Government to establish a Wattle Research Institute, ready support was forthcoming. At this stage it was contemplated that the Government would set up and maintain the Institute aided by a subsidy from the Union, and to make money available for this it was agreed to set up a Research Fund.

The Government, however, while sympathetic towards these representations, indicated that the matter could not be determined until the return of normal conditions. The Minister of Agriculture and Forestry suggested further that a scheme should be prepared in which the Wattle Growers' Union would set up an Institute aided by a government subsidy, thus reversing the relative roles of the Government and the Union.

During 1941 the Union set up a Research Institute Sub-committee consisting of Messrs S. Bailey Bekker, R. B. Fyfe, and D. Ramsay Scott. Draft plans were drawn up and a definite financial offer was made to the Government. Again, however, a decision was deferred and the Minister suggested that the Research Fund should be built up pending the return of more propitious times.

In 1942 a further step was taken when funds were voted to the Government to assist in the appointment of a wattle geneticist. Dr. J. Philp was appointed in December to work in association with Mr. S. P. Sherry, the Forest Research Officer stationed in Pietermaritzburg. It was immediately following this appointment that the Government Wattle Genetics Station was set up at Sweetwaters.

With its appetite whetted by the progress thus far made, the Union Congress of 1943 approved the establishment of a Department of Research within the Union and the appointment of a Director of Research " to investigate and deal with the early establishment of a Research Institute." Dr. Philp was appointed to this post and assumed duty in February, 1944. It was arranged that he should retain the general oversight of the Wattle Genetics Station for which Mr. Sherry now became immediatley responsible under the Department of Agriculture and Forestry.

The Congress of 1944 took a major step in setting aside £30,000 towards the cost of building an Institute and maintaining it in its early years. A Research Board consisting of Messrs S. Bailey Bekker, S. Clegg, R. B. Fyfe, J. Hunt Holley Snr., and J. A. Lidgett was set up. Power to vote further annual sums was conferred upon the General Committee which was also authorized to double the contribution from bark and extract exports if the need should arise.

The next two years were spent in working out detailed plans and costs and in elaborating proposals for the administration of the Institute. It had been recognized

by the Sub-committee appointed in 1941 that association of the Institute with the Natal University College would bring great benefits, particularly by way of contacts between the research staff and the academic staff in related sciences. Library facilities also would be of great value. The College, in turn, would gain reciprocally by contact with the applied science and by the flow of academic research problems expected to arise in the Institute. Certain training facilities could also be made available to advanced students.

The Research Board, taking this a step further, evolved a tripartite scheme in which the three partners were to be the Wattle Growers' Union, the Natal University College, and the Government Department of Forestry. Towards the end of 1945, following a round-table conference presided over by Dr. B. F. J. Schonland, President of the Council for Scientific and Industrial Research, the Government put forward proposals as a basis for final negotiations. The terms eventually agreed upon included provisions that the University College Council should be the authority ultimately responsible for the Institute, which would have its own Committee of Control ; that the cost of the building should be assisted by a grant from the Department of Education ; that equipment and maintenance costs should be assisted by a *pro rata* grant from the Department of Forestry ; and that all wattle research being carried out by the Department of Agriculture and Forestry, with the exception of research in entomology, should be taken over by the Institute within three years of the date of its inauguration. Wattle entomology was to remain the responsibility of the Division of Entomology because of the excellent work in progress at Cedara. The team there had an unrivalled experience of research in this field and had accumulated an invaluable collection of ecological data. A transfer could be effected at the present time only with great difficulty and with an adverse effect upon the work.

A proposal was accepted that the Institute should be placed on the new campus of Natal University College and, at length, it became possible to proceed to the preparation of final plans.

The Committee of Control was constituted in September, 1946, and comprised initially Messrs S. Clegg, J. A. Lidgett, and D. Ramsay Scott nominated by the South African Wattle Growers' Union, Dr. E. G. Malherbe and Professor S. F. Bush nominated by the Council of Natal University College, and Mr. H. B. Stephens nominated by the Union Government Department of Forestry.

Early in 1947, at the end of his three years contract, Dr. Philp resigned his post as Director of the Research Department of the Wattle Growers' Union to return to the United Kingdom. During his period of office he had taken an active part in the involved discussions on ways and means and had drawn up detailed plans for the staffing and upkeep of the Institute. He was responsible for the main features of the layout of the laboratories and offices and had supervised the early stages of the erection of the building.

The first Director of the Institute, Dr. H. Shaw, assumed office on the 1st May, 1947, and the Institute was formally inaugurated as from that date.

BUILDINGS AND PLANTATIONS

Building operations commenced in September, 1946, and the foundation stone was laid by Mr. J. A. Lidgett, M.P.C., President of the South African Wattle Growers' Union, on the 2nd November in the presence of the Administrator of Natal, the Hon. D. E. Mitchell, and Mrs. Mitchell, local senators and members of parliament, and a large company representing the City Council, the University College, government officers, and wattle growers. At that time it was confidently hoped that the building would be completed and furnished in the latter half of 1947. There was, however, a succession of set-backs and major difficulties and this estimate proved to be unduly optimistic. Even at the end of 1948 a good deal of detail still remained to be finished and the building was not completed until April, 1949. In spite of this and because of lack of accommodation elsewhere, a few rooms were taken over in March 1948, and these were supplemented by others as completed. In this way the staff spent a whole year in uneasy and much disturbed partial occupation of the building before taking full possession of it.

Main Building. The building contains 36 rooms of which 13 are laboratories with a total floor space of over 4,000 square feet. There are also external garages, store rooms and native quarters. The larger laboratories each have a store room and an office attached, giving a compact working unit. In addition, a number of services have been provided for the use of all sections, notably a dark room, workshop, and fire-proof records office, as well as the usual administrative offices. There is also a large library-meeting room.

An experiment on the suitability of black wattle (*Acacia mollissima*) for wood block flooring has been incorporated in the building. Two lots of floor blocks were made by the Forest Products Institute and the State Sawmills, Pretoria, from large logs specially supplied for the purpose. One portion consisted of timber from 7 to 10 year old trees rapidly grown in a high rainfall area, the other was from 16 year old trees slowly grown in sandy soil in a drier area. The blocks have been laid in two sets of rooms in the Institute where they can be observed for an extended period under comparable conditions. Other floors in the building have been laid in a West African hardwood muave (*Erythrophleum guineense*), blackwood (*Acacia melanoxylon*), fastigata gum (*Eucalyptus fastigata*), and saligna gum (*E. saligna*).

Another interesting feature of the building will be six panels on the walls of the entrance hall and staircase depicting historical scenes and technical operations in the industry. These paintings have been commissioned by the South African Wattle Growers' Union and are being executed by an artist-wattle grower, Mr. Peter Leftwich. The work will be carried out on hardboard of the kind now being manufactured in Natal from wattle wood.

Laboratories. The laboratories have been furnished and equipped on modern lines with movable sub-bench cupboards and drawers to provide the maximum flexibility. In addition to water and electricity they are provided with a petrol-air gas supply from a central installation. A section of the upper storey has been constructed so as to be convertible to a constant temperature unit should this ever be required. The provisional allocation of the laboratories is as follows :—

Silviculture	one large laboratory
Plant Breeding and Genetics	one large laboratory
Soil Chemistry and Physics	one large and one medium laboratory
Bark Chemistry	one large laboratory
Special Chemistry etc.	three medium laboratories
Pathology	one large and two small laboratories
Biometry and Economics	two medium office-laboratories

Nursery and Field Station. Altogether the laboratory accommodation is of a very high order and should provide excellent working conditions for the research staff. Nevertheless, it must be remembered that in any research institute concerned with agricultural problems, such indoor laboratories are no more than adjuncts, though very necessary ones, to the main laboratory which is the field and plantation. Already a site near the building has been allocated and is now being equipped as a nursery. There remains, however, an urgent need for a field station capable of being worked under commercial conditions. Tree material raised by the plant breeder will need to be planted out on a large scale for growth and yield studies and it is essential that this work should be handled exclusively by trained Institute staff. Further, the Institute must have under its own control parent experiments to serve as reference standards for trials carried out in growers' plantations. The Institute will, of course, always require the co-operation of growers for field experiments since this is the only practicable way in which the influence of different soil types and other environmental factors can be investigated.

Wattle Genetics Station, Sweetwaters. In 1943 the Department of Forestry started a small field station for plant breeding and genetics experiments on about 100 acres of land at Sweetwaters leased from the Pietermaritzburg Corporation. This was planted up by Dr. Philp and Mr. Sherry with selected stocks of black and green wattle and included also were numerous off-type examples of both species and some hybrids between them, as well as a small collection of other *Acacias*. This plant breeding station has now been fully taken over by the Institute under a new lease in the name of the University. Two well-built and serviceable log huts on the site have been handed over to the Institute as a gift from the Department of Forestry.

ADMINISTRATION AND FINANCE

The Research Institute stands on the new University campus on the outskirts of Scottsville where in due course the Faculty of Agriculture and Natal Institute of Agriculture is to be built. It is the first of several Research Institutes to be established in connection with the University.

The management of the Institute is in the hands of a Committee of Control comprising three representatives of the South African Wattle Growers' Union, two of the University Council, and one of the Department of Forestry. The Registrar of the University acts as Honorary Secretary of this Committee. During the period March, 1947, to December, 1948, inclusive, the Committee met on fifteen occasions, several of these meetings being specially convened to deal with urgent matters relating to staff appointments and the Institute building.

The Director of the Institute has the status of a Research Professor in the University and is a member of the University Senate. He is responsible to the Principal for matters of discipline and to the Senate in respect of such teaching as may be carried out in the Institute. Otherwise control of the Institute is exercised directly by the University Council advised by the Committee of Control.

The Institute will not normally undertake undergraduate teaching, though members of its staff may from time to time give special lectures. It will, however, provide facilities for post-graduate research to be carried out in conjunction with appropriate departments of the University. It is hoped that fellowships and scholarships will become available for this purpose.

A Wattle Research Advisory Council is to be set up to maintain contact between the Institute and all sections of the wattle industry. Other interested parties such as the Council for Scientific and Industrial Research and the Leather Industries Research Institute will be represented and members of the University teaching staff in allied fields will also be included. Further provision for close contact with the Leather Industries Research Institute exists in the appointment of the Director of the Wattle Research Institute as Honorary Consultant and member of the Research Advisory Council of the former Institute.

The financial structure of the Institute is a comparatively simple one. The capital cost of the building and certain fixed furnishings, estimated at about £25,000, is being met by the Wattle Growers' Union assisted by a government grant through the Department of Education of £10,000. The cost of the initial technical equipment and the annual maintenance will be provided by the Wattle Growers' Union with government assistance through the Department of Forestry at the rate of 15/- per £ otherwise contributed, with a maximum grant of £5,000 in any one year. The confidence of the industry in the future of the Institute has found tangible expression in the generous gift of £2,500 by the Forestal Land, Timber and Railways Company, Limited for the purchase of apparatus. It has been arranged that this gift shall provide the major items of permanent equipment in the Chemistry Section of the Institute. Certain other items of equipment have been transferred on favourable terms from the Department of Forestry and the Division of Botany and Plant Pathology.

According to present estimates the annual cost of running the Institute, including non-recurring costs of equipment, is likely to range between £9,000 and £12,000 during the first few years.

The finances of the Institute are in the hands of the University Accountant and he is responsible for all payments, book-keeping, balance sheets, etc. The summarized financial statements for 1947 and 1948 appear below, but the final building account is not yet available.

RESEARCH ACCOUNT

1st May, 1947, to 31st December, 1947.

Expenditure.	£	s.	d.	*Income.*	£	s.	d.
Research Staff Salaries ..	1,012	0	0	S.A.W.G.U. Grant ..	1,512	9	10
Travelling and Subsistence	223	17	9	Department of Forestry Grant	984	7	3
Laboratory and Office Equipment	925	14	3				
Library	3	15	10				
Printing and Stationery	2	3	2				
General Administration	329	6	1				
	2,496	17	1		2,496	17	1

1st January, 1948 to 31st December, 1948

Expenditure.	£	s.	d.	*Income.*	£	s.	d.
Research and Administrative Staff salaries ..	5,206	5	6	S.A.W.G.U. Grant ..	5,964	16	7
Travelling and Subsistence	408	10	1	Department of Forestry Grant	4,248	12	5
Laboratory and Office Equipment and Maintenance	4,132	14	1	Department of Education —Cost of Living allowances	125	6	7
Library	178	19	4				
Printing and Stationery	177	1	6				
General Administration	235	5	1				
	10,338	15	7		10,338	15	7

STAFF

The scheme originally envisaged the appointment of a fairly junior staff who, it was hoped, would gain their experience as the work progressed. At a later stage, however, it became evident that the wide diversity of the several sections of the Institute and the high degree of specialization required for their conduct called for a more experienced type of research worker. The proposed salary scales were revised, therefore, and brought into line with those of the C.S.I.R., thus enabling the Institute to compete for the best men available. This policy has had its reward in the first appointments to the senior staff where each individual is a man of established reputation in his own field of work.

The Director of the Institute was appointed in May, 1947, but as accommodation for research staff was not then available, no further appointments were made until early in 1948, when three heads of sections were appointed. In view of the long and unexpected delay in completing the laboratories further recruitment had to be deferred and it has only recently become practicable to advertize additional posts.

The following members of staff have so far been appointed :

Director : Dr. H. Shaw joined the Institute directly from England where for thirteen years he had been on the staff of East Malling Research Station. He was head of the Plant Protective Chemistry Section there and had been closely associated with recent developments in plant pest and disease control.

Geneticist : Dr. A. A. Moffett was for twelve years head of the Plant Breeding Section at the Tobacco Research Station, Southern Rhodesia. Since 1946 he had been Officer-in-Charge of the Station.

Chemist : Dr. W. S. Martin had served for twenty-two years in the Colonial Service as Agricultural Chemist in Uganda and had been Senior Chemist since 1935. On leaving the service in 1946 he joined African Explosives and Chemical Industries as Soil Chemist.

Silviculturist : Mr. S. P. Sherry was for twelve years a research officer in the Union Department of Forestry. From 1940 he was in charge of silvicultural research in Natal and of wattle research in the Eastern Transvaal. For several years he was in charge of the government Wattle Genetics Station at Sweetwaters and worked there in close collaboration with Dr. J. Philp while the latter was Director of the Research Department of the South African Wattle Growers' Union.

Technical Assistants : Mr. N. J. Cunningham and Mr. M. J. Lourens, both of whom were formerly employed by the Wattle Growers' Union as assistants to Dr. Philp and Mr. Sherry, transferred to the Institute staff, the former directly and the latter after a short spell of service in the Forestry Department.

Two other assistants, Mr. A. M. Gale and Mr. E. Hickman, joined the staff straight from school, but resigned after a few months service.

Secretary-Typist : Miss A. P. J. Moberly came to the Institute after serving for several years in the Women's Auxiliary Naval Service.

Two new research posts are about to be filled and additional technical assistants are to be appointed as soon as suitable candidates are forthcoming.

Although insect pest control was in the first place specifically excluded from the Institute's sphere of activity, the numerical inadequacy of the government officers engaged on wattle investigations led the Wattle Growers' Union to press for the appointment of an entomologist on the Institute staff. This was approved by the Committee of Control with the concurrence of the Department of Agriculture and the Division of

Entomology and it is hoped that the post will be filled in the near future. This officer will be able to advise and assist growers in applying pest control methods to their plantations.

The other post about to be filled is that of plant physiologist. This, again, was not provided for in the original estimate of staff, but the need for fundamental information on wattle and the fact that some of the most pressing problems of the industry have a physiological basis have emphasized the need for such an appointment. A wide field of work awaits this officer, including research on the origin and function of tannin in wattle, the nature and mechanism of frost injury and of resistance thereto, interspecific differences in the *Acacias*, methods of vegetative reproduction, the significance of mycorrhiza and nodule bacteria, and physiological disorders of wattle.

There will still remain to be filled the posts of biochemist, biometrician-economist, and, possibly, pathologist, and further appointments will be made as and when facilities become available and the requirements of the Institute become more clearly defined. Non-European laboratory and field assistants will be provided as required. Routine administration, including library work, is at present in the hands of a secretary-typist, but additional junior assistance will be required in due course.

ADVISORY WORK AND COMMITTEES

It was not to be expected that at this early stage in the life of the Institute advisory work would loom very large. Nevertheless, forty advisory letters were sent out during the year and in several instances visits were paid to growers' plantations to get first hand information on a problem or to amplify and explain the recommendations made. Several special investigations were also undertaken by the Institute staff. Of these perhaps the most interesting and useful was the help given to a grower following a disastrous fire which destroyed about two-thirds of his plantations and completely upset the rotation. Assistance was given in replanning the layout of the estate and towards re-establishing a rotation with the minimum delay. Two cases of suspected, but unusual frost damage have been examined, and a previously unknown type of wood-rot in wattle poles cut for mining timber is at present being investigated.

The help of the Institute has been enlisted by important commercial interests seeking to establish industries that would provide valuable additional outlets for wattle timber. Chief among these have been firms manufacturing paper, rayon, and hard-board. Data on the quantity and distribution of available timber have been furnished as well as detailed information on technical points raised in these enquiries.

Further evidence that the existence of the Institute is already widely known is found in the approaches made to it by government research organizations in the Sudan, Indonesia, and Brazil and by the Colonial Development Corporation in Great Britain. These have sought to establish contacts and to arrange interchanges of information and material. In the case of the Colonial Development Corporation, the help of the Institute has been sought to advise on a development project to be undertaken in conjunction with the Tanganyika Government.

The Institute, most ably assisted by various sections of the industry, organized an educational exhibit on behalf of the Wattle Industry at the Royal Show held in Pietermaritzburg in June. On this occasion emphasis was laid upon the products of the industry and their wide variety of uses, both actual and potential. An arresting display attracted much attention and was rewarded by the award of First and Special Prizes in the Industrial Section.

In July, 1947, and again in June, 1948, Dr. Shaw attended the Annual Meeting in Port Elizabeth of the Research Advisory Council of the Leather Industries Research Institute and on each occasion took part in discussions on the Institute's research programme. He also visited the Institute in Grahamstown in May, 1948, in order to discuss wattle problems more fully with the individual workers engaged on them. Dr. Shuttleworth, Dr. Cunningham, and Dr. Kritzinger of the Leather Institute have all visited the Wattle Research Institute and taken part in discussions there.

LIBRARY

Substantial progress was made during 1948 in establishing a specialist library in the Institute. In view of the close proximity of the University Library and the prospect of having as near neighbour the Faculty of Agriculture with its library, it is not necessary for the Institute to attempt to cover the field of general science or even of general agriculture. This makes practicable the building up of a really comprehensive library devoted to those subjects of immediate interest and importance to the Institute. At the end of the year 35 scientific periodicals etc. were being taken and some 75 books and 670 bulletins and pamphlets had been acquired. Thanks are due in particular to the following institutions, each of which has generously contributed a large number of its publications :—

Leather Industries Research Institute, Grahamstown, South Africa.
Forest Products Institute, Pretoria, South Africa.
Forest Products Laboratory, Princes Risborough, England.
Division of Forest Products, Melbourne, Australia.
Forest Products Laboratory, Madison, Wisconsin, U.S.A.
California Forest and Range Experiment Station, Berkeley, California, U.S.A.
Imperial Institute, London, England.
Boyce Thompson Institute for Plant Research Inc., Yonkers, New York, U.S.A.

The library is one of the most important working tools of the research staff and because of this it is not possible to allow outside borrowing except under the arrangement between the various scientific libraries in the country. Nevertheless, the library is available, by arrangement with the Director, to wattle growers, students, and other interested persons and any such are very welcome to use the facilities of the Institute in consulting literature. A list of the journals, books, bulletins etc. will be available as soon as these have been classified and indexed.

PROGRAMME OF EXPERIMENTAL WORK IN PROGRESS

(a) INTRODUCTORY.

The accumulated experience of a large number of agricultural research stations over many years is unanimous in indicating that a thorough fundamental knowledge of the plants or crops under investigation is a pre-requisite of successful applied research. Without it the practical problems of immediate importance to the grower can be dealt with only on an empirical basis largely of trial and error. In so far as this fundamental knowledge lies in the field of general biology it is largely supplied by the universities, hence the importance of the closest possible contact between so-called pure and applied research. Where, however, it relates in detail to a special crop such as wattle, it can be provided only by a research institute whose staff is in intimate and continuous contact with that crop. In short, the worker must know his plant literally to the roots.

On the other hand it is recognized that any institute for applied research can justify itself only by the service it gives to the industry and by the improvements in methods and productivity that it is able to effect. The research programme of such an institute must, therefore, provide a reasonable balance between essential long-term fundamental work and investigations designed to assist the grower in his cultural operations and in meeting his day to day problems. Undue concentration upon the first could quickly cause an institute to lose itself in a world of academic detachment ; exclusive attention to the latter would withhold the very weapons with which to attack these practical issues.

Although the Institute is, of necessity, physically divided up into subject sections, the basic conception of its research work is as an integrated and co-ordinated whole. A large proportion of this work will, in fact, consist of joint projects. It is here, by bringing all the branches of the work into the closest possible contact with each other, that the Institute should enjoy one of its chief advantages over the separate agencies hitherto engaged on wattle research. By this means it can be ensured that every problem of the industry is approached on the broadest basis, with full weight given to every point of view. The addition of lines of investigation not previously being pursued, e.g. soil studies, completes something approaching the ideal organization for research investigations in a major agricultural industry.

During the autumn and winter of 1948, when it was frequently impossible to work in the Institute because of building operations in progress, the Director and senior research staff took the opportunity to visit a representative selection of plantations in all the main wattle-growing areas. Extremely valuable contacts were thus made and first-hand information was obtained of the chief problems confronting growers in the various districts. The result of this left little doubt that the outstanding problem of the industry as a whole, and of the Eastern Transvaal in particular, is that of frost injury. In some districts, whole areas are slowly going out of wattle cultivation because of the difficulties encountered in re-establishing. Second only to this, in the growers' view, is the need for more objective and satisfactory basis for the purchase of bark, ideally on the basis of tannin content.

These tours have been of the greatest assistance to the staff in bringing the problems of the industry to a focus and enabling them to be seen in true perspective. It is hoped that they will be repeated at frequent intervals so that there may always be easy and effective contact between the growers and the research staff. The tours also provided opportunities for a general soil reconnaissance most useful in allocating field experiments, and for a survey of material likely to be useful in the plant breeding work.

Round about 1938 a series of silvicultural experiments located at centres in all

the main wattle-growing areas was laid down by the Department of Forestry. These were planned and initiated by the Forest Research Officer, Mr. R. P. Stephens, and in 1940 they came under the supervision of Mr. S. P. Sherry who had succeeded Mr. Stephens. As the wattle disease experiments carried out by Dr. M. S. J. Ledeboer in the Division of Botany and Plant Pathology came to an end in 1946, and as the Division of Chemical Services, Cedara, had ceased to do bark analyses, these silvicultural experiments, together with the wattle breeding work at Sweetwaters, constituted the work actually in progress and to be transferred to the Institute. It was part of the agreement with the Department of Forestry that this work should be taken over completely by the Institute within three years from the date of inauguration, and the implementing of this agreement was the first task awaiting the Institute.

When, however, Mr. Sherry was appointed to the post of Silviculturist in the Institute the whole complexion of the change-over was altered and the process greatly simplified. In fact, the experiments proceeded with unbroken continuity, for the two technical assistants who had previously worked on them also joined the Institute staff.

The result of this is that all wattle research in progress in the Department of Forestry at the time of the inauguration of the Institute was taken over completely within twelve months. Resumption of the suspended work on bark analysis now awaits only the arrival of apparatus and equipment, while the resumption of the pathology investigations awaits the appointment of a suitable officer. The silvicultural aspects of disease control are being actively investigated already.

(b) SILVICULTURE.

WORK IN PROGRESS.

1. Thinning Experiments Initiated by the Department of Forestry.

(a) The thinning experiments at Honey Grove, Deasenne, and Kranskop were stripped during 1948 and the results of these experiments (with the exception of analytical data) have been written up. The stripping of the thinning experiments at Windy Hill and Muirton will be completed in this same season.

The stripping of the remaining thinning experiments, namely those at Hillcrest, Grovedale, Spring Valley and Cramond (experiments in green wattle) should be completed during the 1949/1950 season.

(b) A second thinning experiment at Muirton, designed to test the effect of different rates of thinning on gummosis incidence may also be stripped next season, but this will depend on the stripping programme of the estate concerned.

2. Thinning Experiments Initiated by the Institute.

(a) A comprehensive thinning experiment has been laid out at Broadmoor on a block which was stripped in the 1948/1949 season. This block was inspected before felling and the site appeared to be reasonably even and representative of average second quality sites elsewhere in the Natal Midlands as judged by the growth and condition of the trees. The experiment is designed to test the effect on yield of standard thinnings, covering a range of final densities from 200 to 1,000 trees per acre, over four rotation periods of 7, 9, 11, and 13 years respectively. Each treatment is replicated four times in a randomized block layout.

(b) A thinning experiment will be laid out at Kranskop during 1949 to test the effect on the incidence of gummosis of widely different rates of thinning to the same final density. The site chosen is the block on which a Forest Department thinning experiment has been established during the past decade and in which there was a high incidence of gummosis during the first five years growth of the crop. Four thinning treatments will be tested as follows :—

(i) Thinning to 500 trees per acre when trees are 6″ high.
(ii) Thinning to 500 trees per acre in four operations of approximately equal intensity when trees are 6″, 5′, 15′, and 25′ high respectively.

(iii) Thinning to 500 trees per acre in seven operations of gradually decreasing intensity when trees are 6″, 2′, 5′, 10′, 15′, 20′, and 25′ high respectively.
(iv) Thinning to 500 trees with deliberate suppression in the early stages and more rapid release after the trees reach a height of 15 feet.

In addition, hand pulling of weeds and hoeing will be tested separately in conjunction with each thinning treatment and the eight combined treatments will each be replicated four times in a randomized block layout.

3. Root/Shoot Ratio Studies.

These have been carried out on black wattle seedlings from the time of germination up to three months of age. These studies will be continued when nursery space is available and combined with a study of the rate of lateral root spread in wattle seedlings.

4. Vegetative Propagation.

Preliminary trials of partial ring-barking of wattle branches, as a means of inducing callus growth and hence accelerating rooting in branch cuttings, have been carried out at Sweetwaters. This work will be extended when nursery space is available.

5. Plantation Valuation.

Data on plantation working costs have been collected in order to calculate average standing value of plantations at different ages. It is hoped by this means to derive a standard method for valuation of immature plantations which can be used as a basis for plantation insurance.

6. Bark and Timber Yield Tables.

Data for sample trees are being accumulated with a view to deriving bark and timber yield tables applicable to each of the main zones in the Industry. The effect of treatment upon bark thickness and bark yield is also being investigated by means of an analysis of sample tree data.

PROJECTED EXPERIMENTAL WORK.

1. Thinning Experiments.

It is proposed to repeat the experiment described in 2.(a) above on average first and third quality sites, probably during the 1949/1950 season.

2. Frost Control Experiments.

(a) *Shelterwood regeneration of wattle in frosty areas.* Following up commercial experiments, it is proposed to attack this problem in two ways: firstly, in areas where wattle can no longer be re-established, to plant up an artificial shelterwood of pine which will be heavily thinned if and when the wattle regrowth appears; secondly, in areas where wattle regrowth is liable to be frosted off after clear-felling, to carry out a partial felling at rotation age, leaving about fifty trees per acre to serve as an overwood until regeneration is effected, after which they will be felled.

(b) *Fertilizing of wattles in frosty areas.* There are indications from past experience that wattles which have received dressings of 200 lb. or more of superphosphate have been able to survive frosts which have killed back unfertilized wattles in the same experiment. It is proposed therefore to test the effect of different applications of superphosphate in increasing the resistance of young wattles to frost.

(c) *Clean cultivation of wattles in frosty areas.* Following up growers' experience in the Kambula area, it is proposed to test the effect of clean cultivation of young wattle stands in reducing frost damage.

3. Weeding Experiments.

The weeding experiments laid down by the grower at Broadmoor will be studied to determine whether increment is unduly affected by no hoeing as compared with complete hoeing. At the same time observations will be made on the incidence of wood rot symptoms in plots laid out in all three treatments. The information so gained will be used in planning similar controlled weeding experiments elsewhere.

4. Vegetative Propagation.

Further methods will be studied in order to facilitate the rapid building up of new strains and varieties selected by the geneticist for special features such as resistance to frost and to pests and diseases, high bark yield and tannin content, suitability for marginal areas, and other desirable characteristics.

FUTURE WORK.

1. Study of Brushwood Burning versus Non-Burning.

The effects of burning and non-burning on soil moisture relationships, erosion, fertility, pest and disease incidence, attacks by animals, frost damage, and yields of bark and timber should be studied as a long term project.

2. Economic Investigation of Plantation Operations.

This would involve a study of existing management methods, including time and motion studies on operations employing native labour, in order to find means of reducing production costs. The possibility of replacing manual with mechanical methods would also be investigated and data on costs of all plantation operations in different parts of the industry would be collected by direct observation in the field.

(c) PLANT BREEDING AND GENETICS.

WORK IN PROGRESS.

1. Breeding.

The following lines of genetical work, commenced by Philp and Sherry at Sweetwaters, are being continued :

(a) Selfing of the first inbred generation of green wattle to produce the second inbred generation. Unfortunately, the 1948 season was unfavourable for seed production with the result that very little selfed seed was obtained.

(b) Selfing of hybrids between green and black wattle. A small number of seeds resulted.

(c) Selfing of black wattle. A number of trees were selfed to determine whether the breeding mechanism was the same as in green wattle and to establish inbred lines for possible heterototic recombinations.

(d) Attempts to produce further hybrids between green and black wattle. These failed owing to the unfavourable conditions.

2. Pollination Mechanism.

From an examination of the pollen and styles, it does not appear that wattle is specially adapted for wind pollination. The possibility that insect transmission of pollen may play a considerable part in cross pollination should be further investigated, since it may effect the spatial distance necessary for the isolation of breeding material.

3. Seed Germination.

Seed germination tests were made with two objectives in view :

(a) as a preliminary to colchicine treatment of seeds and

(b) to determine whether the initial stages of growth could be carried out *in vitro* with subsequent transplantation to pots.

For colchicine treatment to be successful the drug must be absorbed with the first intake of fluid and germination should be rapid.

Complete removal of the seed coat gave good germination within 24 hours, but proved to be too laborious to treat a large number of seeds. Various degrees of removal of the seed coat were then tried until it was found that a small cut penetrating the coat at the distal end of the seed produced almost as rapid germination as complete removal of the seed coat.

The germination of seeds so treated was more even and rapid than that of seeds treated with boiling water.

The uneven germination of seed after boiling water treatment led to a further study of the effects of this treatment. A random sample of commercial seed was divided into three groups designated " large," " medium," and " small." Germination tests following boiling water treatment showed that the germination was more rapid and even in the " small " group than in the " medium " or " large " groups. The end results of the germination tests still showed significant differences between the " small," " medium," and " large " groups, although the differences were not so marked as in the early stages of germination. The difference in germination between size classes did not appear when seeds were germinated after cutting the seed coat. There is evidently an interaction between seed size and hot water treatment.

The fact that the smaller seeds give a more rapid initial and higher final germination after boiling water treatment may mean that selection for small seed is in progress in commercial plantations, should the difference in seed size prove to be hereditary.

4. Colchicine.

Seed treatment with colchicine was commenced with three objectives in view :

(a) The production of tetraploid lines of black wattle which might bring about an immediate improvement on the present diploid lines.

(b) Tetraploid lines should extend the range of possible species crosses and might facilitate hybridization with indigenous acacias, which are already tetraploids.

(c) The production of immediately fertile new species by wide crosses between wattle and other acacias followed by chromosome doubling.

In preliminary tests six colchicine treatments ranging from 0.06% to 1.0% for for 24 and 48 hours were tried. All treatments produced very marked distortion of the seedlings, but in nearly every case the treatment proved to be too severe. Only two seedlings have survived out of 240 treated.

A further six treatments varying from 0.01% colchicine to 0.1% were then applied. All treatments again produced marked distortion, but in the lower concentrations of colchicine, root growth was not inhibited. It appears that many seedlings transferred to pots after treatment will survive.

While colchicine treatment has had a very marked effect ,it is too soon to say whether it will be possible to establish tetraploid lines.

5. Twin Seedlings.

In a number of species of plants when twin seedlings occur it has frequently been found that one of the twins has a different chromosome number from the other. In the course of seed germination tests and colchicine trials two twin seedlings were observed. Subsequently, with a view to finding further twins, a large number of seeds were treated with boiling water and among the 7,000 seeds which germinated one twin seedling occurred. A further 6,000 seeds, germinated following similar treatment, yielded no further twin embryos. The total germination of seed following boiling water treatment was only about 60%, due, apparently, to delayed germination and to mucilage produced by the treatment rendering the seeds liable to fungal and bacterial attack.

Since cutting the seed coat, instead of treating with boiling water, had given rapid even germination and a high degree of freedom from fungal attack, it was decided to prepare a number of seeds by this method to determine whether there was any difference in the frequency of occurrence of twin embryos. In 8,200 seeds so prepared a germination of 96% resulted and 5 twin embryos occurred. The higher proportion of twin seedlings following the cutting of the seed coat as opposed to hot water treatment further confirms the differential effect of the latter on seed germination.

It has not been possible, as yet, to examine the chromosome numbers of twin seedlings, but if these follow the pattern of other plants they should yield valuable polyploid material.

PROJECTED WORK.

1. Type Collection.

The formation of a collection of black and green wattle types together with other species of acacia likely to be of economic use will be started. It is particularly important to endeavour to get black wattle from as many different geographical and climatic areas of Australia as possible. The material, when assembled, will be examined and tested for frost resistance, tolerance to insect attack, tannin content, etc. with a view to immediate use or as a basis for a breeding programme. Such a collection may provide breeding material not present in the wattles grown in South Africa.

2. Progeny Tested Parent Trees.

As the basis for a programme of general improvement in the black wattle, trees selected on morphological and chemical characteristics will be further tested by the behaviour of their progeny. Trees shown to be outstanding by the progeny test will be propagated vegetatively, the clones thus established being intermixed in isolated plantations. Cross pollination between these selected clones should produce a superior strain either immediately or after repetition of the process for one or more generations.

3. Frost Resistance.

As a preliminary to selection for frost resistance an attempt will be made to find some method of evaluating relative resistance other than the crude method of planting seedlings in a frosty area. Three possible methods of estimation will be tested :

(a) Relative cell sap concentration. In some crops a higher cell sap concentration has been shown to be correlated with frost tolerance.

(b) An electrical conductivity method claimed to have given good results in Russia.

(c) Subjection of seedlings to various temperatures below freezing followed by rapid thawing.

4. Cytology.

(a) A cytological survey of colchicine-treated material.

(b) A study of pollen mother cell divisions of hybrids to determine the degree of differentiation of parent species.

FUTURE WORK.

1. Hybridization.

Work on species hybrids, including attempts to produce hybrids between widely differing species of acacia and wattle, will be expanded.

Hybridization will have as an objective the transference to the black wattle of frost resistance or tolerance to insect attack from other species. The scope of this work will depend to a considerable extent on the success of colchicine treatments in doubling the chromosome number.

2. Induced Mutations.

Attempts to induce mutations by treatment with X-rays, heat, etc. will be made.

(d) CHEMISTRY.

(i) SOIL.

WORK IN PROGRESS.

1. Soil Survey.

A reconnaissance soil survey will assist in the location of fertilizer experiments.

2. Fertilizer Experiments.

These have been designed to find the effects of the major plant nutrients, nitrogen, phosphate, potash, and lime, on the growth and yield of wattle. The nutrients are being used at three rates of application, both alone and in all possible combinations, in order to find an economic balanced fertilizer for wattle. Similar trials will be conducted later at five centres on different soil-climate types so that suitable fertilizer treatments may be designed for each area.

3. Phosphate Assimilation.

The phosphate in the main fertilizer experiments will be applied in the form of superphosphate. It is possible that on acid soils, other less soluble forms of phosphate will be more economic. Simple plot experiments have therefore been planned to compare the effects of superphosphate with those of metaphosphate and rock phosphate.

PROJECTED WORK.

1. Mineral Uptake.

In addition to the major fertilizer trials, detailed studies of the uptake of minerals by the wattle tree at different stages of growth will be undertaken to throw some light on the problem of the optimum time of application of nutrients.

2. Burning versus Non-Burning.

The effects of burning and non-burning on soil organic matter and available nutrients will be studied.

3. Cultural Practice and Soil Condition.

The effects of different silvicultural treatments on soil structure and on rainfall penetration and soil moisture retention will be investigated.

4. Frost Injury Studies.

The incidence of frost injury in relation to soil conditions and the mineral nutrition of the crop will be examined.

5. Minor Element Requirements.

Simple pot and plot experiments coupled with plant tissue tests will be made to find out the minor element requirements of wattle.

FUTURE WORK.

1. Soil Survey.

A more detailed soil survey of wattle-growing areas must be undertaken to assist in the formulation of fertilizer programme and in the application of the results of other soil and silvicultural studies.

2. Phosphate Availability.

Soil studies are required on the effects of organic matter and of soil acidity on the reversion of phosphate to insoluble forms.

PROJECTED WORK.

1. Bark Analysis.

All routine samples will be analysed by the International Procter method and by as many other methods as may be enolved in order to find a rapid method which will give concordant results in agreement with Procter figures.

2. Bark Grading.

The technique of bark sampling and analysis will be examined with a view to elaborating practicable methods for grading bark on the basis of tannin content.

3. Tannin Content in relation to Bark Thickness.

Re-examination of the bark thickness-tannin content correlation may provide an approach to the problem of bark grading from another angle.

4. Tannin Content in relation to Age.

An examination of the age-tannin content correlation is necessary to facilitate the early evaluation of new strains and varieties. If a reliable estimate of the bark and tannin-producing potentiality of young trees could be made it would greatly reduce the amount of material to be handled by the plant breeder.

FUTURE WORK.

1. Bark Drying Studies.

Many growers are unable to dispose of their produce as green bark and normal methods of stick bark preparation often result in a reduction of tannin content and deterioration in quality. It is proposed therefore to conduct experiments on the controlled artificial drying of bark to find out if it is possible to make a higher grade product economically.

2. Tannin Biochemistry.

Studies of the formation and the function of tannin in plant tissues require the collaboration of a plant physiologist.

The programme will be co-ordinated with all routine bark examinations for other sections of the Institute.

(e) MISCELLANEOUS.

Certain investigations in progress or projected are not specifically allocated to any one section, but are being dealt with at present on an *ad hoc* basis. These include the following :

WORK IN PROGRESS.

1. Collaboration with other Organizations.

(a) *Collection and collation of plantation data.* The Institute is fortunate in that the progressive policy of the Natal Tanning Extract Co. Ltd. has enabled that firm to make available a very large quantity of data derived from its own extensive plantations. This free exchange of information has made possible a co-ordination of effort that will avoid wastefull duplication and will result in a much wider coverage than could have been secured without it.

Several discussions, on problems of mutual interest, have taken place between members of the Institute staff and technical officers of the Company and these have already proved fruitful of ideas and suggestions for further work, particularly in the direction of soil studies.

Plant breeding material also has been placed at the disposal of the Institute.

(b) *Studies on the tannins of black and green wattle.* The Leather Industries Research Institute is engaged upon an examination of the chemical constitution and tanning properties of the tannins of black and green wattle. All the material for this purpose is collected by the Wattle Research Institute, involving the selection and stripping of suitable trees and the packing of the bark samples under special conditions to minimize subsequent changes.

(c) *Determination of insecticide residues.* An investigation has been started on the analytical methods available for determining the amount of benzene hexachloride deposited on wattle foliage by insecticide spraying. This information is required by the Division of Entomology in connection with the experiments on control of the Wattle Bagworm.

(d) *Studies of wood rot in mining timber.* Field investigations have been made by the Institute staff to assist the Division of Botany which is carrying out a laboratory examination of this problem.

2. Weed Control by Chemical Means.

Preliminary trials have been carried out to determine the effect of various weed-killers on certain troublesome weeds notably bugweed (*Solanum auriculatum*), American bramble, (*Rubus cuneifolius*), and star-burr (*Acanthospermum australe*). Some of the chemicals have shown promise, but further work on optimum conditions and dosage is required.

PROJECTED WORK.

Timber Utilization.

The actual and potential uses of wattle timber fall into two main groups :

(a) Processes in which the timber is used as such, e.g. fuel, mining timber, wood turning, and floor block manufacture.

(b) Processes involving the chemical or physical conversion of the wood, e.g. the manufacture of paper pulp, rayon, hardboard, charcoal, distillation and fermentation products.

Detailed investigation of these processes can be carried out only by the specialized industries concerned, but the Institute can contribute to this work, not only by providing a service of information as indicated elsewhere in this Report, but by carrying out determinations of the properties of wattle timber and by-products in relation to the requirements of these various industries. It is already clear that in almost all the examples cited, the chief difficulties preventing exploitation of the surplus wattle timber are not technical, but economic.

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To all the growers who have co-operated in field experiments, sometimes at the cost of dislocation of their own routine.

All these, among others, have made a highly valued contribution to the task of setting in motion the wheels of the new machine.

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